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TERRITORIAL DIFFERENCES IN THE INNOVATIVE DEVELOPMENT OF SWEDEN, FINLAND, AND THE NORTH-WESTERN FEDERAL DISTRICT OF THE RUSSIAN FEDERATION

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This article considers the innovative component of the economies of Sweden, Finland, and the Noreth-western federal district (NWFD) of the Russian Federation. The authors present the results of a comparative analysis of research and technological potential of the regions and their administrative-territorial units in terms of innovative activity development. For the first time, the index of integral assessment of research and technological potential of the NWFD has been calculated in comparison to Sweden and Finland. The NWFD is proved to lag behind Sweden and Finland in terms of innovative development indices; however, the NWFD shows an increase in such indices in catches up in terms of individual indices (mobile communication density and Internet access availability). The authors offer sketch maps showing similarities in the character of territorial differentiation of innovative processes in the NEFD, Sweden, and Finland (which corresponds to the centre-periphery model).

***Key words*:** innovative development, research and technological potential, territorial differences, North-western federal district of the Russian Federation, Sweden, Finland

In comparison to the statistical average among other Russian regions, the North-western federal district (NWFD) is characterized by a higher level of innovative development; nonetheless, it significantly lags behind Finland and Sweden, the countries promoting the most cutting-edge approach to both production and implementation of innovations in the economy.

In terms of socio-economic development, Sweden ranks 21st in the world and 8th in Europe (in 2011 its GDP per capita accounted for 40 600 dollars[1]) [16]. Despite its rather small population, Sweden is 23rd in the world among 225 countries and 9th in Europe in terms of total GDP

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(379, 4 billion dollars). These figures are mostly determined by its innovative economy and achievements in the field of research and technology during the 20th century. In 2009, Sweden's R&D expenditures amounted to 10.5 billion euros, which was only slightly behind the R&D spending in the whole Russian Federation and more than 7 times surpassed the corresponding figures in the NWFD.

Finland ranks among countries with a high level of socio-economic development (GDP per capita — 38 300 dollars in 2011) coming 26th in the world and 11th in Europe [16], surpassing Germany, the economic leader of the EU (GDP per capita — 37 900 dollars). At the same time, due to relatively small population it remains only 55th in the world in terms of its total GDP. A new innovative economic model which has formed in Finland in the past two decades contributed a lot to the goals that Finland set for the country. The R&D expenditures reached 6.8 billion euros in 2009, which accounts for 62 % of Russia's R&D expenses and 4.7 times exceeds the R&D costs in the NWFD. Finland is a leading research-intensive country — its R&D expenses account for 3,9 % of its GDP [19]. The share of private and public funding in the total R&D expenditures accounts for 70 % and 30 %, respectively.

The Russian Federation ranks 69th in GDP per capita in the world (16,700 dollars), lagging 2.4 and 2.3 times behind Sweden and Finland, respectively. By its total GDP (2380 billion dollars, 6th place in the world) Russia ranks higher than these countries, by 6.3 and 12 times, respectively. However, the contribution of innovations in Russia's GDP is much lower than that in Sweden and Finland, which occupy respectively the 1st and 3rd places in the innovation index of the Member States of the European Union [18].

The NWFD contributes to 9.9 % of Russia's GDP, i. e. 236 billion dollars. According to this index, the NWFD outpaces Finland by 1.2 times, but lags 1.6 times behind Sweden [1]. The District's population of 13.6 million people, or 9.5 % of the total population of Russia, is 1.4 times bigger than Sweden's (9.5 million) and 2.5 times bigger than Finland's (5.4 million). However, in terms of GDP per capita output NWFD exceeds the average figures throughout the Russian Federation only by 4 %. Therefore, the gap between Sweden, Finland and NWFD in GDP per capita is almost the same as between these Nordic countries and Russia.

The NWFD is characterized by a higher level of innovation activity in comparison with other Russian regions. About 15 % of Russian companies engaged in research and development are located in north-west, the share of advanced manufacturing technologies developed in the NWFD is 20 % of Russia's total. The number of advanced manufacturing technologies per 10 thousand people in north-west is slightly lower than the national average.

In the innovation and research sector the NWFD is characterized by a higher (compared to the total number of the population) share of those involved in research and development, R&D expenditures, the number of developed high-end technologies; however, the volume of innovative goods and services produced in the NWFD is not sufficient yet. The NWFD's share in the total number of patent applications, the number of patent protection documents, the volume of innovation and technology development funding

by companies is slightly lower than in the Russian Federation compared to its share in the total population of Russia (Table 1). This indicates that innovative products created in the NWFD, especially St. Petersburg, as a rule, are subsequently transferred to other regions of the country.

Table 1

The share of the NWFD in the Russian Federation according to certain indicators of innovative development and the number of population, %

Indicator	The share of the NWFD in the RF
The number of people involved in research and development	13
The number of researchers holding an academic degree	12,29
Gross domestic expenditure on research and development	13,5
Patent applications and protection documents	8,4
Number of advanced manufacturing technologies	17,4
The number of advanced technologies used	8,2
Expenditures on technological innovation	9
The volume of innovative products and services	9,7
The number of the population	9,5

* Calculation based on the data provided by the Russian Federal State Statistics Service [2].

Comparative evaluation of the level of innovation in north-west Russia, Sweden and Finland was based on the calculation of the integral index of scientific and technical potential using available statistical data of Rosstat and Eurostat for the period 2007—2009 (Table 2).

Table 2

Dynamics of indicators in science and technology in NWFD, Sweden and Finland, 2007—2009, %*

Indicator	NWFD			Sweden			Finland		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
The number of R&D personnel in the total number of EAP	1,36	1,29	1,28	1,54	1,62	1,55	2,1	2,1	2,09
The number of R&D personnel among the average number of annually employed population	1,52	1,46	1,45	1,64	1,73	1,69	2,26	2,24	2,28

End of Table 2

Indicator	NWFD			Sweden			Finland		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
The share of people employed in the high-tech manufacturing sectors	35,1	34,4	33,7	44,5	44,5	35,2	44,2	44,2	41,3
Population with higher education	17,9	17,2	…	27	27,5	27,9	30	30,2	30,9
Gross domestic expenditure on research and development, the share of GDP / GRP	1,74	1,73	1,9	3,61	3,75	…	3,48	3,73	…
The share of enterprises and companies involved in innovation (technological, organizational, marketing etc.)	9,8	8,9	9,5	45	54	…	51	52	…
Level of innovative activity of small enterprises	5,1	…	4,5	6,5	6,5	…	9,7	9,7	…
Internet coverage	30	39	65	78	84,4	86	69	72,4	77,8
Expenditure on ICT, the share in GDP / GRP	1,22	1,25	1,33	5,2	5,3	5,6	5,5	5,5	5,5
The number of patent applications per 1 million inhabitants	241,1	259,8	241,7	298,8	315,7	332	233,9	224,4	215,6
Export volume of high-technology products, the share in the total export	1**	0,9	1,1	13,8	13,5	…	17,5	17,3	…
Share of innovative products and services in the total volume of goods and services	3,4	3,7	3,1	15	9,2	…	15,7	15,6	…

* Calculation based on the following data: [3—6; 20; 25].

** Calculated on the basis of export structure of the NWFD and the RF, as well as the export ratio of high-tech products in the RF: 2007 — 1.2 %, 2008 — 1.2 %, 2009 — 1.6 %.

According to the modified method of integrated assessment of scientific and technical potential, the indicator rationing has been done on the basis of linear scaling in each survey year. Along with that, the minimum and maximum rates for the each variable remained fixed during the whole reviewed time period. After that, the average value was calculated in each of the groups: personnel, research, R&D facilities, and research and technological potential of the staff. Then convolution of individual index meanings in the group was made. As a result of the analysis, the following indices of integral assessment were received for the NWFD, Sweden and Finland for the period 2007—2009 (Table 3).

Table 3

Integral assessment of research and technical potential, 2007—2009*

Year	North-western Federal District of Russia	Sweden	Finland
2007	0,063	0,715	0,876
2008	0,067	0,741	0,884
2009	0,082	0,681	0,871

* Calculation based on the following data: [3—6; 20; 25].

Statistics show a large gap in research and innovation development between the NWFD and the selected countries. The analysis of the structure of the scientific and technical potential of the NWFD by the integral index calculation showed that during the analysed period the innovative development of the region occurred mainly due to the growth and improvement of R&D facilities and equipment, while in Sweden and Finland research, innovation and technology demonstrate the most dynamic growth.

Sweden and Finland invest significantly larger financial resources (coming primarily from business investment) in innovation, promoting more active involvement of human resources, which results in high figures for patent applications, as well as a bigger share of organizations engaged in innovation and using modern information technology.

Despite the fact that Russia, in particular the NWFD, is lagging behind in terms of innovation development, a high patenting activity of the country was noted during the reviewed period. Thus, in 2009 in the number of patent applications (relative to GDP) Russia outpaced Finland by 32%, and Sweden by 62%. The outdistancing of the RF in the number of patent applications compared with R&D expenditures turned out to be even more significant (4 and 6.5 times higher than those of Sweden and Finland, respectively). Russia's major competitors in the ranking of innovation active countries are the USA, Japan, Korea, China and Germany.

In Sweden and Finland, countries having a relatively moderate number of patent applications in comparison with R&D expenditures (0.2 and 0.3 million U.S. dollars, respectively, which is 16.5 and 11 times less than in the leading Korea), the number of patent applications relative to GDP surpassed many advanced countries in 2009.

Assessing the state of the innovation sector, one should pay attention to the dynamics of indicators describing the level of the Internet access and the number of mobile phones. These indicators reflecting the introduction of modern means of communication clearly demonstrate a rather high speed of innovation diffusion process. Practical benefits of innovations are recognized by both business and general public. In this respect, the NWFD is well positioned not only in comparison with the RF as a whole, but also with Sweden and Finland.

Over the period 2002—2011, a qualitative change in the number of workstations connected to the Internet took place in Russia, and especially in the NWFD. In the NWFD, the number of Internet connections per 100 inhabitants amounted to 61 in 2011, against 93 in Sweden and 89 in Finland, while in 2002 this ratio was as follows: 4 — in the North-West Russia, 58 — in Sweden, and 51 — in Finland (Figure 1).

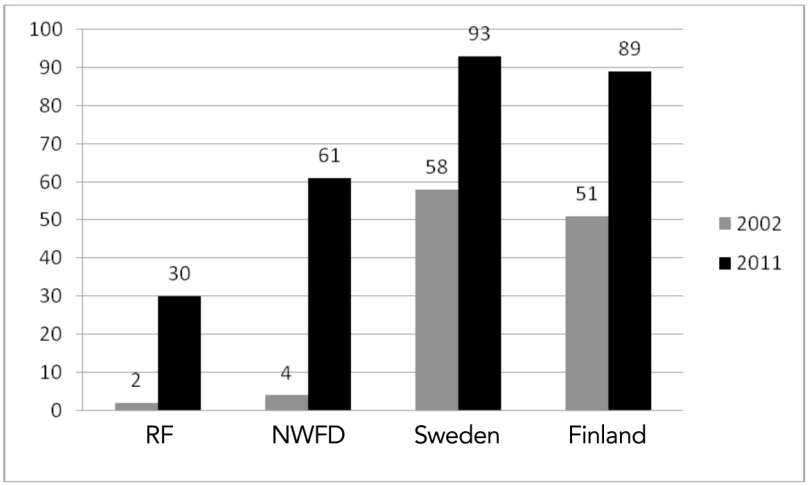

Fig.1. The number of workstations connected to the Internet (percentage of the population), years 2002 and 2011 [2; 7; 16]

The dynamics of increase in the number of SIM cards sold in 2002—2011 as a percentage of population is even more impressive. In 2005, this indicator in the NWFD reached, and in 2006 exceeded that of Finland and Sweden (Fig. 2). In 2011, the number of sold mobile SIM cards amounted to 172 per 100 inhabitants compared with 196 in the NWFD, whereas in Finland this indicator was159, and in Sweden — 117.

Of particular interest are territorial differences in the level of innovation of the economy in the NWFD, Sweden and Finland.

The degree of innovation of Swedish counties (lens) varies significantly (Fig. 3, Tab. 4). Counties of Stockholm, Uppsala (where Sweden's oldest university is located) and Östergötland (with its most famous technical university) show the highest innovation level, whereas the worst rates are witnessed in the periphery counties of Jämtland and Gotland.

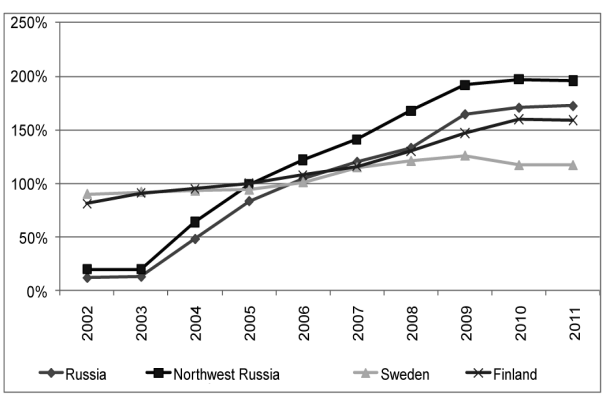

Fig. 2. Increase in the number of SIM cards sold in 2002—2011 as a percentage of population [2; 7—16]

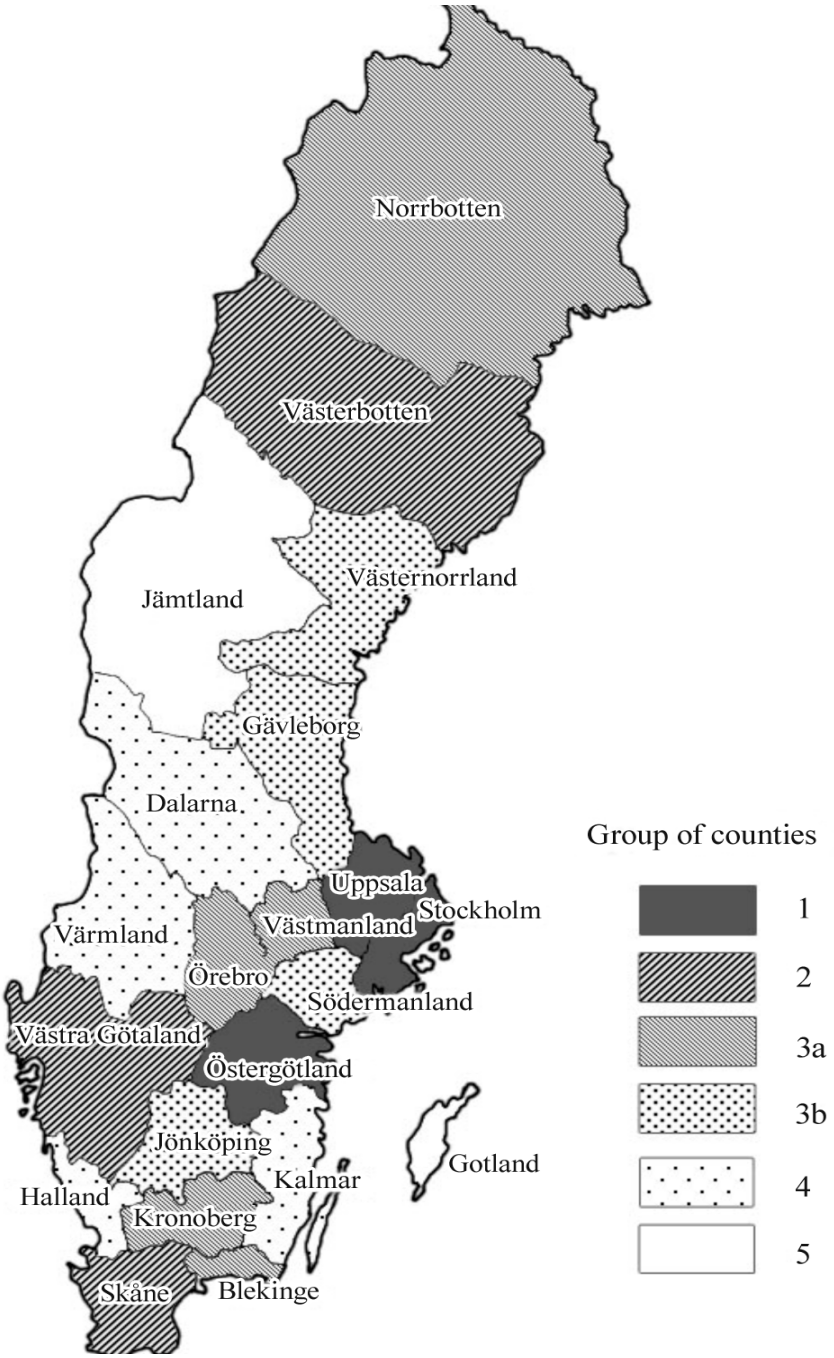

Fig. 3. Grouping of Swedish counties in terms of innovative development [17, 22, 23]

Table 4

Grouping of Swedish counties in terms of innovative development*

Group of counties	Research and development expenditures (million kronas per 1000 inhabitants)	Number of people employed in research and development (per 1000 inhabitants)	Number of granted patents (units per million inhabitants)
1	18—21	17—27	100—200
2	11—16	12—16	75—120
3а	5—8	6—10	70—125
3б	4—5	5—7	80—110
4	2	3—5	40—75
5	0,4—0,7	0,4—4	50—60

* Calculation based on the following data: [17; 22; 23].

Regions of Finland also vary greatly in terms of their innovation activity, which is associated with the differentiation of higher administrative-territorial units of the country (Figure 4 and Table 5).

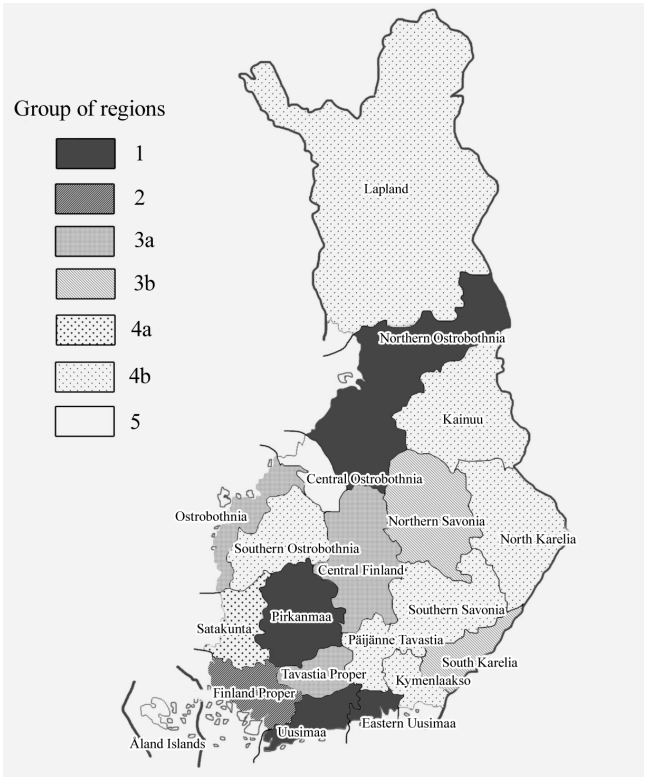

Fig. 4. Grouping of Finnish regions according to the level of their innovative development [21]

Table 5

Grouping of Finnish regions according to the level of their innovative development

Group of counties	Research and development costs (thousands euro per 1000 inhabitants)	Number of people employed in research and development (per 1000 inhabitants)	Number of granted patents (units per million inhabitants)
1	2000—2500	20—25	100—200
2	1500	16	70
3а	500—1000	8—13	100—150
3б	600—700	10—12	40—60
4а	400	5	150
4б	150—500	3—10	20—60
5	50—250	1—4	—

* Calculation based on the following data: [21].

The highest rates are registered in the metropolitan region Uusimaa (the region of Eastern Uusimaa merged with it in 2011), the adjacent Finland Proper, as well as Pirkanmaa region with its capital Tampere located in centre of the country and Northern Ostrobothnia in the north. Worst performance was recorded on the eastern, western and northern peripheries, especially on the Aland Islands.

The evident leader in north-west Russia in terms of innovative development is Saint Petersburg, Russia's second-largest innovation centre after Moscow. In absolute terms, the difference between other regions of the NWFD regarding innovation is much smaller than that between each of them and St. Petersburg. However one can distinguish several different groups of regions within NWFD (Figure 5, Table 6). Thus, Group 2 comprises Leningrad and Novgorod regions, as well as the Komi Republic. The volume and share of innovative products, goods and services per 1000 inhabitants there is significantly higher compared with other regions (except St. Petersburg); furthermore, both figures correspond to the average in the NWFD and Russia.

In general, the regions belonging to the second group have a more innovative economy in comparison with the regions of Group 3 and Group 4, but not more innovative than the national average.

In terms of innovation potential, characterized by research costs per 1000 inhabitants and the number of patents granted per 1 million inhabitants, regions of Group 3 differ slightly from those of Group 2, while Subgroups 3a (Murmansk, Vologda region and the Republic of Karelia) and Subgroup 3b (Pskov, Arkhangelsk, Kaliningrad region) are practically on the same level. The main difference lies in a lesser degree of innovation of their economies. Most unfavourable indicators are observed in the Nenets Autonomous Okrug (Group 4).

So far, the NWFD is lagging significantly behind Sweden and Finland in terms of innovation development, but during the past few years, this gap has been reducing, and in individual indicators (such as the spread of mobile communications and the Internet), it was even bridged. Nevertheless, considerable efforts are required to increase innovation in the economy of Russian regions, including the NWFD.

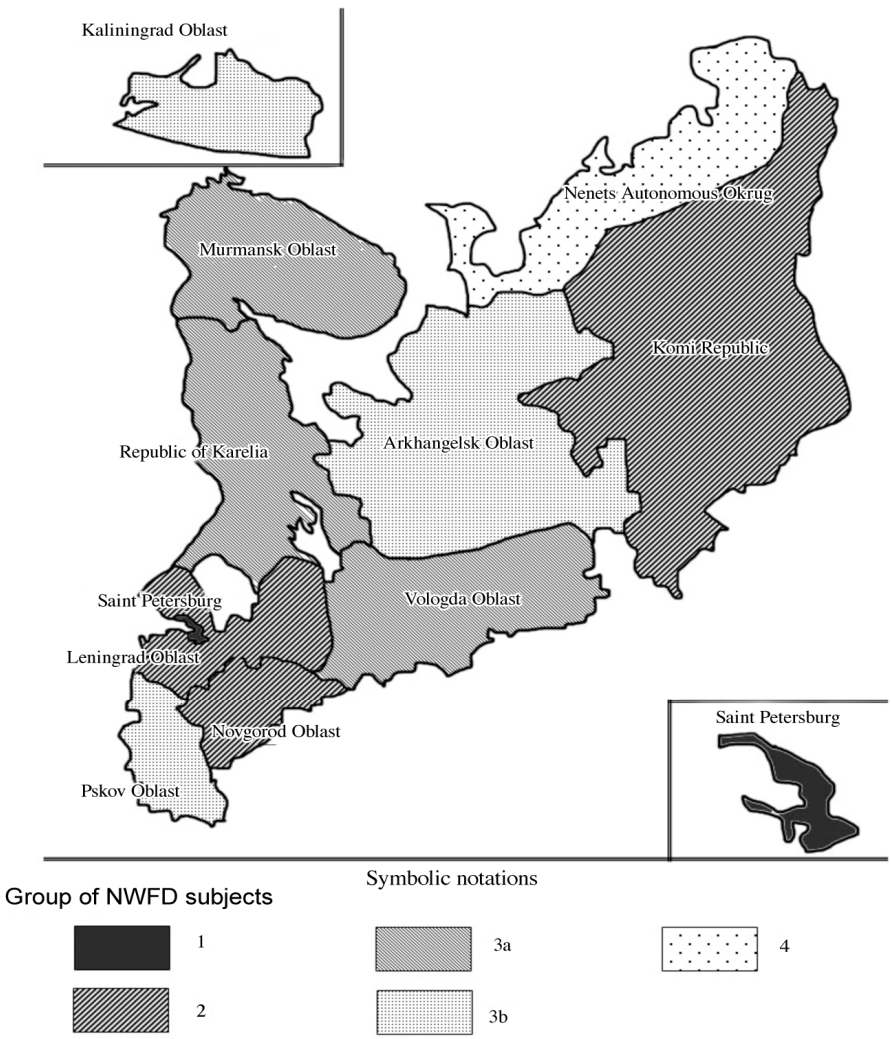

Fig. 5. Grouping of NWFD regions according to the level of their innovative development [2]

Table 6

Grouping of NWFD regions according to the level of their innovative development*

Group of regions (oblasts)	Region	Gross domestic expenditure on research and development (million rubles per 1000 inhabitants)	Patents granting (per 1 million inhabitants)	Expenditure on technological innovation (million rubles per 1000 inhabitants)	Volume of innovative Products, works and services (millions of rubles per 1000 inhabitants)	The volume of innovative products and services (as% of their total volume)
1	Saint Petersburg	12	445	4,1	17	8
2	Leningrad region					
	Komi Republic					
	Novgorod region	1—3	40—75	1—3,5	5—11	2—7
3а	Murmansk region					
	Vologda region					
	Republic of Karelia	0,1—3	40—75	2—3,5	1—5	0,5—2
3б	Pskov region					
	Arkhangelsk region					
	Kaliningrad region	0,1—1,5	40—85	0,2—0,5	0,2—2	0,1—3
4	Nenets Autonomous Okrug	1	—	0,03	—	—
	Russian Federation	3,7	223	2,8	8,7	4,8
	NWFD	5,2	198	2,6	8,8	4,1

* Calculation based on Rosstat data: [2].

Territorial differentiation of innovation potential is typical for the NWFD, as well as for Sweden and Finland, and actually corresponds to the centre-periphery model. Although all of the constituent entities of north-west Russia have innovative potential, Moscow obviously stands out among them. That is why it is advisable to strengthen its role in the development of still weak horizontal links between regions of the NWFD. It is necessary to develop partnerships between universities and research organizations in St. Petersburg and other regions and republics of North-West Russia, as well as partnerships between these regions and republics. Facilitating exchange of information and best practices of innovative development between companies of the NWFD is also of high importance.

Compared to the majority of Russian regions, NWFD regions have certain competitive advantages in innovation development, such as the implementation of R&D projects in various fields of innovation and technology in cooperation with other countries of the Baltic Sea Region.

The location of NWFD regions close to the more innovatively developed regions of Sweden and Finland is a prerequisite for building a broader and deeper partnership in cross-border cooperation. This is facilitated by the projects of the "Interreg" programme which was initiated by the European Union. Regarding the NWFD and its regions, it would be extremely beneficial for the Russian Federation, to launch a similar international programme that would consider innovation as its top priority.

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